Makeham's User Guide

This guide provides important details regarding the implementation of Makeham's Law in R.

Select Period

An important implementation detail is regarding the select period. In all cases, a select period is assumed by default when using an actuarial function. This means that

- ${}_tp_{[x]}$ is implemented such that using a non-zero s arugment results in ${}_tp_{[x]+s}$
- $A_{[x]}$ is implemented such that using a non-zero s arugment results in $A_{[x]+s}$
- $\mu_{[x]}$ is implemented such that using a non-zero s argument results in $\mu_{[x]+s}$

  $\vdots$

For instance, lets say that the select period is 2 and the value of A_{20} is wanted. Calling `Ax(20,s=2)` actually gives the value $A_{[20]+2}$ and not A_{20}. Therefore, this value would have to be calculated as $A_{[18]+2}$ which is `Ax(18,s=2)`

To generalize the model to any select period, numerical integration was used in the implementation of several functions. For instance, the functions implementing ${}_tp_x$ and A_x use numerical integration. Although this provides for flexibility in changing the model parameters, the disadvantages of such an approach are

- Running code such as building life tables takes noticeably longer when a large select period is used, such as $d = 10$
- In addition to a function using numerical integration potentially being slow, it is also less accurate than solving an integral before programming the function

Optional arguments

Typically, as is the case with the $A_{[x]}$ function, rather than implementing new functions such as $\bar{A}_{[x]}$, these are optional parameters to the existing function. For instance, $\bar{A}_{[x]}$ can be calculate as `Ax(x,c=1)` where c is an optional parameter indicating that a continuous expected present value should be calculated.

```
> library(makehams)
> head(createLifeTable(x=20))
```

```
   x   l[x]+0   l[x]+1      lx+2 x+2
1 NA       NA       NA 100000.00  20
2 NA       NA       NA  99975.04  21
3 20 99995.08 99973.75  99949.71  22
4 21 99970.04 99948.40  99923.98  23
5 22 99944.63 99922.65  99897.79  24
6 23 99918.81 99896.43  99871.08  25
```